Ferromagnetic Infused Microstructure Arrays For Cell Sorting And Method Of Their Fabrication

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BRIEF DESCRIPTION

Researchers at the University of California, Irvine have invented a system for biological cell sorting using ferromagnetic infused microstructure arrays. The invented system is an adherent cell sorting platform with individually addressable growth substrates for specified cell release and collection using integrated magnetic structures.

Some previous cell sorting methods have sacrificed the image clarity of the samples that they have sorted due to the process by which they sort cells. The invented micro array platform allows for the capture of individual components while also maintaining ideal imaging conditions.

FULL DESCRIPTION

The invention is a system for biological sell sorting using an array of microstructure with each individual microstructure component including an integrated magnetic element. The invention eases the process of retrieving microstructure that have been disassociated from larger arrays, particularly when being used for biological cell sorting.

Modern methods of cell sorting typically remove selected cells from a larger culture through chemical or physical means. These cells are then suspended in imaging solution and are ran through sorting devices designed to detect physical characteristics to sort cells such as fluorescent labels, size, and other distinguishing features.

The sorting conditions of existing modern methods are especially unfavorable to adherent cell health and viability, and can lead to altered cell behavior, which can negatively influence research results. Adherent cells are of vast interest and include stem and cancer cells. Researchers working with these cell types greatly benefit from the possibility of sorting and separating specific cells from diverse populations. Therefore, there is a need for a platform that is capable of minute cell differentiation while avoiding cell function alteration due to standard sorting platform methods.

There have been previous attempts at addressing the problems associated with adherent cell sorting. Efforts have been made to allow adherent cells to stay in contact with their growth substrates while sorting is being conducted. Automated systems have been designed to replace manual hand sorting with robot controlled pipettes and scalpels to selectively remove targeted cells and cell colonies from culture.

While automated systems help solve the problem of the labor intensive manual sorting, they still suffer from disadvantages and limitations as hand sorting. These methods inevitably leads to the loss of purity of cells as physically retrieving specific cells from others around them is not trivial. The chemical used to digest cell connections to their growth surfaces can also cause unwanted alterations to cell phonotypes post sorting.

Instead of relying on or trying to improve upon existing automated sorting processes and keeping known flaws, it becomes necessary to design systems that work around these known issues. One such solution is the use of microarrays which sequester individual cells onto their own growth surfaces, so that collection does not lead to loss of sample purity.

Micro arrays composed of single cell sized structures designed specifically for cell culturing have proven to be powerful tools for cell analysis and sorting by allowing for the physical manipulation of plated cells without the need for chemical digestion from their growth surfaces. These arrays are typically composed of patterned,

OTHER INFORMATION

KEYWORDS

Microarray, Cell Sorting, Electroplating, Micropallet, Magnetic Array

CATEGORIZED AS

» **Research Tools**
» Other
» **Sensors & Instrumentation**
» Scientific/Research

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biocompatible photo resist on glass slides. They are designed to sequester individual cells or cell colonies onto their surfaces in order to separate heterogeneous populations into discrete groups, which can be easily separated from one another.

When a cell of interest is located on a structure within the array, a laser targeted at the base of the structure is used to eject the individual components from the array. Currently, the most efficient way to collect these components is to invert the entire array over a collection plate, thus utilizing gravity to transfer structures no longer adhered to the glass slide.

A major disadvantage related to this method of microstructure transfer is a loss in specificity and purity among captured samples. By relying on gravity, there is no control over where the collected samples actually fall within the capture plate, which may lead to the unwanted mixing of cells. Previous methods aimed at solving this issue allow for the individual capture and transfer of released structures, but they sacrifice the image of the samples during analysis. The invented method solves these problems by providing a microarray platform which allow for the capture of individual components while also maintaining ideal imaging conditions.

One version of the invented system will consist of an array of transparent microscale structures with through holes photolitographically patterned into a conductive surface, each individually filled with a small section of nickel created through electrolytic metal patterning. The nickel structures are constrained to the corner of the microstructures in order to allow for unhindered imaging of captured samples on the transparent regions. Magnetic probes will be utilized to individually collect ejected structures from the array. In some versions of the invention, there will also be the addition of vertical chambers, which are adhered over the surface of the arrays to hold cell culturing liquids.

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SUGGESTED USES

Sorting and separation of Biological Cells.

ADVANTAGES

The magnet infused microstructure arrays allow for the direct collection of biological cells adhered to their surfaces without loss in imaging clarity through the structure. These structures lead to greater data acquisition, faster cell collection, and more efficient overall adherent cell sorting than previous cell sorting technologies.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,675,627	06/09/2020	2015-782

STATE OF DEVELOPMENT

There are plans to design, manufacture, and test prototype magnet infused microstructure arrays.

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